UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF NEW YORK

- X

UNITED STATES OF AMERICA,

Plaintiff,

- against -

Civil Action
No. CV- 07-0835

(Seybert, J.)
(Orenstein, Ch. M. J.)

AGI-VR/WESSON COMPANY;
ALLOY CARBIDE COMPANY;
CHI MEI CORPORATION;
CLIMAX MOLYBDENUM COMPANY;
CLIMAX MOLYBDENUM MARKETING CORPORATION;
COUNTY OF NASSAU, NEW YORK;
CYPRUS AMAX MINERALS COMPANY;
GENERAL ELECTRIC COMPANY;
GTE CORPORATION;
H.C. STARCK, INC.;
KENNAMETAL INC.;
M & R INDUSTRIES, INC.;
MINMETALS INC.;
OSRAM SYLVANIA CORPORATION;
PHILIPS ELECTRONICS NORTH AMERICA CORPORATION;
SANDVIK AB;
TDY HOLDINGS, LLC; and
TDY INDUSTRIES, INC.,

Defendants.

- - - - - - - - - - - - -- - - - - - - - - - - - - - - - - X

APPENDIX D PART 8 TO THE CONSENT JUDGMENT

SITE BACKGROUND DETERMINATION

Location ____________________
____

AVE ____________________

3σ______________________

Range _________ to _______

MDA _________dpm/100cm²

Performed By: ____________

Date: ___________________

Location ____________________
____

AVE ____________________

3σ______________________

Range _________ to _______

MDA _________dpm/100cm²

Performed By: ____________

Date: ___________________

Comments:

j:\belding\table\bkground.vsd

ECC, SOP-R105
PROPORTIONAL DETECTOR CALIBRATION AND CHECK-OUT

1.0 PURPOSE

To describe the procedures for calibration and operational check-out of proportional detectors

2.0 RESPONSIBILITIES

The site health physicist is responsible for assuring that this procedure is implemented. Survey team personnel are responsible for following this procedure.

3.0 PROCEDURE

3.1 Equipment

- Portable ratemeter-scaler: Model 2200 or 2221 Ludlum Instrument Corporation; or equivalent.
- Proportional detector: Model 43-68 Ludlum Instrument Corporation; or equivalent.
- Cable: C-C; or other connectors, as applicable.
- Record forms.
- Calibration source.
- Check source.

3.2 Procedure

3.2.1 Purge detector

3.2.1.1 Attached P-10 gas supply and detector outlet hoses to flow meters. Refer to operating manual.

3.2.1.2 Turn on main bottle valve and adjust flow rate to approximately 100 cc/min. Allow to purge for 5 minutes. Reduce flow to approximately 40 cc/min and continue purging for 20 minutes.

3.2.1.3 Attach the detector to a portable ratemeter-scaler.

3.2.1.4 Check the condition of the batteries. The instrument is fully charged at 6 volts. Models 2200 and 2221 are inoperable at 4.4 volts or less. Replace batteries if necessary.

3.2.1.5 Adjust the threshold setting to 50 (5.0mV). (This value applies to both the alpha and the alpha-beta modes.)

3.2.1.6 Set high voltage to approximately 110 V. Note source count rate.

3.2.1.7 Note source count rate two (2) minutes later. If the count rate varies by greater than " 10% of first count, unit is adequately purged and ready for use. Record purge check values on the Calibration Form.

3.2.1.8 Disconnect the out flow line and replace with a tubeless coupling to allow for continuous venting of the system. Continuous flow is required during calibration.

NOTE: Unit may be used in the static mode if a good seal can be established. The length of time a static purge can be maintained varies for individual detectors. To operate in static mode, disconnect both hoses from the detector. Begin checking source response as soon as the background count rate begins to drop off. If a decline of approximately 10% or more is noted, the system must be repurged.

3.2.2 Construct a Plateau Curve

The operating voltage is determined based on the characteristics of a plateau curve. Curves are constructed once a year, after major repairs to a detector, and when a new detector is received. These curves are kept on file in the instrument room.

3.2.2.1 Place the detector on one of the alpha calibration sources having a disintegration rate greater than 50,000 dpm.

3.2.2.2 Turn the high voltage down, then gradually increase voltage until the meter begins to register counts.

3.2.2.3 The speaker unit may now be turned off.

3.2.2.4 Accumulate counts for 0.5 minute.

3.2.2.5 Record voltage setting and count rate.

3.2.2.6 Increase voltage to next higher even multiple of 50 V.

3.2.2.7 Accumulate counts for 0.5 minute and record voltage and count rate.

3.2.2.8 Repeat 3.2.5.6 and 3.2.5.7 until the count rate begins to increase rapidly with increased voltage.

3.2.2.9 Prepare a graph of count rate vs. voltage. This graph should consist of a relatively flat section where there is little increase in count rate over a voltage range of up to several hundred volts. This voltage range is called the plateau region for the detector.

3.2.2.10 Select an alpha operating voltage at the midpoint of the plateau region and indicate the value on the graph. (This operating voltage typically ranges between 1000 and 1300 volts.)

3.2.2.11 If detection of beta is also required, place the detector on a beta calibration source having a disintegration rate greater than 50,000 dpm. Continue accumulating and recording 0.5 minute counts at 50 V increments to obtain the alpha-beta plateau. This region will not be as Aflat@ as the alpha operating region but should still be distinguishable. Do not increase the voltage into the continuous discharge range as damage to the instrument/detector may result.

3.2.2.12 Select the alpha-beta operating voltage slightly above the Aknee@ at least 75 V below the level of continuous discharge. Indicate the operating voltage on the graph. (This operating voltage typically ranges between 1,500 to 1,750 volts).

NOTE: If the plateau region is not distinguishable, adjust voltage and accumulate 0.5 minute counts at each 25 V increment in the region where the plateau is expected to occur.

3.2.3 Adjust the instrument setting to the predetermined alpha operating voltage and record the value on the Calibration Form.

3.2.4 Determine the detector background counts for 5 minutes. If the count rate is zero or exceeds 3 cpm, repeat the count. If it falls out of this range again, the unit should be removed from service until repairs can be made. Calculate and record the count rate per minute.

3.2.5 Select an alpha calibration source which will provide approximately 10,000 cpm.

3.2.6 Position the alpha calibration source at the approximate center of the detector and accumulate the count for one minute. Record the source identification number and the source count.

3.2.7 Calculate the detector efficiency and round the result to two significant figures. (Typical efficiencies range from 18 to 21%). Record the operating efficiency.

3.2.8 Calculate the minimum detectable activity (MDA) using the following formula:

$$\text{MDA (dpm/100 cm}^2) = \frac{2.71 + (4.65 \sqrt{B})}{T \times E \times G \times \text{other modifying factors}}$$

B = background (total counts)

T = ~~count time (min) to be used for~~ field measurements

E = operating efficiency $\frac{\text{counts}}{\text{disintegration}}$

G = geometry $\frac{\text{detector area cm}^2}{100}$

This formula calculates the activity level in dpm/100 cm^2 which can be detected with 95% confidence of having neither a false positive nor a false negative result.

Compare this value to the site guidelines to determine adequate sensitivity of the instrumentation. An MDA that is less than 50% of the applicable criteria is desirable.

3.2.9 Position an alpha check source at the approximate center of the detector and accumulate the count for one minute. Record the source position, count rate and time. Remove the detection from the source. Reposition the detector and source and repeat the count. Repeat 10 times. Calculate the average value and the 3 sigma deviation of these numbers.

The 3 sigma value should be # 10% of the mean. If it is not, the instrument/detector combination must be removed from service until repairs can be made. Record all information.

NOTE: This same check source is to accompany the calibrated instrument to the field survey site.

3.2.10 Prepare a daily Instrument Operational Check-Out Form. Enter the average check source count rate, the average background count rate and the count times on the first data line. Enter acceptable range limits for background and check source response.

NOTE: This form accompanies the instrument to the survey site.

3.2.11 Daily instrument operational check-out as performed according to SOP-R100.

3.2.12 Adjust the voltage to the specified alpha-beta operating voltage and record the value on the

Calibration Form.

3.2.13 Determine the alpha-beta background for 1 minute. Repeat 10 times. Calculate the average value, the 3 sigma deviation, and the range. Record the information on the back of the form.

3.2.14 Repeat steps 3.2.5 through 3.2.10 using beta calibration sources of an energy applicable to the survey site. (Typical efficiencies range from 18-25%.)

NOTE: Problems have been noted when using proportional detectors in high altitude areas. It may be necessary to establish the operating voltage and perform calibration on-site. Special arrangements must be made by the Project Leader to remove the calibration sources from the laboratory.

CALIBRATION DATA --ALPHA/BETA

Site ________________

Instrument Type ______________________ Instrument Number __________________________

Detector Type _______________________ Detector Number ____________________________

Calibration Source: Radionuclide ____________________________

ID Numbers _____________________________ ___________________

_____________________________ ___________________

Purge Check: 1st __________________________ Time _________________________________

2nd __________________________ Time _________________________________

Source Disintegration Rate (dpm)	Gross Instrument Count Rate (cpm)	Net Instrument Count Rate (cpm)	Efficiency (cpm/dpm)		Check Source Reproducibility Test (c/__m)

Operating Efficiency ______________Ave = ______

(highest activity source) 30 = _______

High Voltage ______________________ Thershold ______________ Window ______________

Check Source Radionuclide _________________________ Check Source I.D. # _____________

Position of Check Source Relative to Detector ____

Average

Background c/__m _____________ Check Source Range _______________ To _______ c/__m

(Ave +-30)

IMPORTANT: ALL OF THE ABOVE INFORMATION MUST BE PROVIDED

Date _____________________________ Calibrated by ________________________________

RFP/007/1200/REV0

RFP/OO8/1200/REV0

BACKGROUND DETERMINATION

Location ________________

____

AVE ____________________

3σ______________________

Range _________ to _______

MDA _________dpm/100cm²

Performed By: ____________

Date: ___________________

Comments:

j:\belding\table\bkgr.vsd

INSTRUMENT OPERATIONAL CHECK-OUT FORM

Instrument Type ______________________ Detector Type _______________________
Instrument # _________________________ Detector # __________________________
Site ___________________________________ Efficiency __________________________
Voltage ______________________________ Threshold ___________________________

Check Out Date	Background (c/__m)	*Source Type: ID#: c/__m	**Source Type: ID#: c/__m	Checked Out By	Comments (see reverse)

Background Response limits _____to ______ c/m
*Source Response limits ________to ______ c/m
**Source Response limits _______to ______ c/m

RPF/003/1200/REV0

SITE BACKGROUND DETERMINATION

Location ____________________

AVE ____________________

3σ ____________________

Range _________ to _______

MDA _________dpm/100cm²

Performed By: ____________

Date: ___________________

Location ____________________

AVE ____________________

3σ ____________________

Range _________ to _______

MDA _________dpm/100cm²

Performed By: ____________

Date: ___________________

Comments:

j:\belding\table\bkground.vsd

ECC, SOP-R106
PRESSURIZED IONIZATION CHAMBER AND CHECK-OUT

1.0 PURPOSE

To describe the procedure for operational check-out of the pressurized ionization chamber.

2.0 RESPONSIBILITIES

The site health physicist is responsible for assuring that this procedure is implemented. Survey team personnel are responsible for following this procedure.

3.0 PROCEDURE

3.1 Calibration

The pressurized ionization chamber is used as a secondary standard for cross calibration of other gamma measuring instruments. Calibration of this equipment is therefore performed by the manufacturer. Recalibration is to be performed biennially or at any time repairs of the instrument are required.

3.2 Operational Check-out

Immediately following calibration by the manufacturer, the initial operational check-out is to be performed on the PIC.

3.2.1 Assemble PIC, turn on, check rechargeable and 300 V batteries. Recharge and/or replace batteries if necessary. Allow to stabilize for approximately 5 minutes.

3.2.2 Determine the background and the gross and net check source exposure rates and record the information on the PIC Tracking Form (Figure 5.7-1).

3.2.3 Record the acceptable range for the response to the check source as " 10% of the net value.

NOTE: This form is kept in the instrument room files.

3.3 Transport to Survey Site

Prior to transport to a survey site; an operational check-out is to be performed on the PIC.

3.3.1 Assemble PIC, turn on, check batteries and allow to stabilize for approximately 5 minutes.

3.3.2 Transfer the acceptable net check source (See 3.2.3) response limits from the PIC Tracking Form to the PIC Field Check-Out Form **(Figure 5.7-2)**.

3.3.3 Determine and record the background, and the gross and net check source exposure rates.

3.3.4 Compare the net check source exposure rate to the acceptable net check source response limits. If the response is within the limits, record the information for the background measurement and the gross and net check source measurements on both forms. If the net exposure rate does not fall within the acceptable range limits, remove the PIC from service until repairs can be made.

NOTE: The PIC Field Check Form accompanies the instrument to the field survey site.

3.3.5 Refer to ECC SOP-R112, Gamma Radiation Measurement for the steps required for general gamma screening.

PIC TRACKING FORM

Instrument # ________________________

Checkout Date	**Background (FR/hr)**	**Source Check # ___________**		**Battery Check**	**Performed By**	**Comments (see reverse)**
		Gross FR/hr	**Net Fr/hr***	**%Charge ****		
						Initial Operational Check

* Response limits _____________ to _____________FR/hr (net)

** Response must be >85% for the 300V battery

NOTE: This form is kept in the ESSAP instrument room files.

RPF/009/1200/REV0

PIC FIELD CHECK-OUT FORM

Instrument # ______________________

Checkout Date	Background (FR/hr)	Source Check # ___________		Battery Check	Performed By	Comments (see reverse)
		Gross FR/hr	Net Fr/hr*	%Charge **		
						Data

* Response limits _____________ to _____________FR/hr (net)

** Response must be >85% for the 300V battery

RPF/010/1200/REV0

ECC, SOP-R107
COMPENSATED GM DETECTOR CALIBRATION AND CHECK-OUT

1.0 PURPOSE

To describe the procedures for calibration and operational check-out of energy-compensated GM detectors

2.0 RESPONSIBILITIES

The site health physicist is responsible for assuring that this procedure is implemented. Survey team personnel are responsible for following this procedure.

3.0 PROCEDURE

3.1 Equipment

- Portable ratemeter-scaler: Model 12, Ludlum Measurements, Inc.; or equivalent.
- Energy compensated GM detector: Model 44-38, Ludlum Measurements, Inc; or equivalent.
- Cable: Series C; or other connectors, as applicable.
- Record forms.
- Calibration source.
- Check source.

3.2 Procedure

3.2.1 Attach the detector (shield closed) to a portable scaler.

3.2.2 Turn on, check batteries, and replace if necessary.

3.2.3 Adjust high voltage to 900 V and threshold to 5 (50 mV).

3.2.4 Determine background for 5 minutes and calculate background count rate. Record the value.

3.2.5 Cross-calibration can be performed; as for gamma scintillation detectors, see SOP-R102. Calibration for exposure rates at levels exceeding the capability of the PIC can be performed under the direction of staff health physicists. Record information on the Cross Calibration Form or the Exposure Rate Calibration Data Form.

3.2.6 Determine check source reproducibility by positioning a gamma check source (Co-60 or Cs-137) on the side of the detector and determine and record the count rate on the Calibration Form. Repeat 10 times and calculate average and 3 sigma deviation. Record check source range.

NOTE: This same source is to accompany the calibrated instrument to the field survey site.

3.2.7 Prepare an Instrument Operational Check-Out Form entering the background and average check source counting rates on the first data line.

NOTE: This form accompanies the instrument to the survey site.

3.2.8 Daily instrument operational check-out is performed according to SOP-R100.

CROSS CALIBRATION FORM

Site ____________________ PIC Number ________________________________ Surveyors _____________________________________

Calibration Point										
Date										
PIC Readings Fr/hr										
Observed Readings in K Counts/Minute										
Meter / Detector No. No.										
/										
/										
/										
/										
/										
/										
Mean: Meter										

Remarks: ____

RPF/006/1200/REV0

INSTRUMENT OPERATIONAL CHECK-OUT FORM

Instrument Type ________________________ Detector Type _________________________
Instrument # ___________________________ Detector # _____________________________
Site ______________________________________ Efficiency ____________________________
Voltage ________________________________ Threshold _____________________________

Check Out Date	Background (c/__m)	*Source Type: ID#: c/__m	**Source Type: ID#: c/__m	Checked Out By	Comments (see reverse)

Background Response limits _____to ______ c/m
*Source Response limits ________to ______ c/m
**Source Response limits _______to ______ c/m

“

Date Reviewed

SITE BACKGROUND DETERMINATION

Location ____________	Location ____________

AVE ____________________

3σ ____________________

Range _________ to _______

MDA _________dpm/100cm^2

Performed By: ____________

Date: ___________________

AVE ____________________

3σ ____________________

Range _________ to _______

MDA _________dpm/100cm^2

Performed By: ____________

Date: ___________________

Comments:

j:\belding\table\bkground.vsd

EXPOSURE RATE CALIBRATION DATA

Instrument Type ______________________________ Probe ______________________________

Instrument Number ______________________________ Source ______________________________

Check Source ______________________________ Background ______________________________

CALIBRATION				
Distance	**Calculated Rate**	**PIC Measured Rate**	**Instrument Measured Rate**	**CPM/FR/hr**

Efficiency ______________________________ CPM/FR/HR (average) ______________________________

Check Source Range ______________________________ To ______________________________ c/m

Calibrated By ______________________________ Date ______________________________

RPF/011/1200/REV0

ECC, SOP-R209
UNRESTRICTED RELEASE SURVEY PROCEDURE

1.0 PURPOSE

The Unrestricted Release (UR) survey process is intended to assure that future use of any potentially radiologically contaminated items of property, without regard to restrictions, will not result in the public being exposed to unacceptable levels of radiation and/or radioactive materials. Additionally, the overall goal of the procedure is to adequately survey materials using a method that will demonstrate compliance with applicable unrestricted release criteria.

1.1 Criteria

The release criteria selected are those generally used by the United States Nuclear Regulatory Commission (USNRC). The criteria are found in several USNRC documents, one commonly referenced source being Regulatory Guide 1.86, A Termination of Operating Licenses for Nuclear Reactors@. Table 1, Acceptable Surface Contamination Levels, is based upon criteria from Regulatory Guide 1.86, and forms the minimum acceptable limits for the UR program. More restricive limits will be used at the request of the contracting government agency.

Table 1
Acceptable Surface Contamination Levels

Nuclide [a]	**Average** [bc] **dpm/100 cm^2**	**Maximum** [bd] **dpm/100 cm^2**	**Removable** [ba] **dpm/100 cm^2**
U-238, U-nat, U-235, and associated decay products	5,000 %	15,000 %	1,000 %
Ra-226, Transuranics, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I129	100	300	20
Th-232, Th-nat, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 β-γ	15,000 β-γ	1,000 β-γ

a Where surface contamination by both alpha-and beta-gamma- emitting nuclides exists, the limits established for alpha- and Beta-gamma-emitting nuclides should apply independently.

b As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive materials as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

c Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each object.

d The maximum contamination level applies to an area of not more tan 100 cm^2.

e The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

1.1.2 Selection Criteria

The following surveillance criteria will be considered prior to implementing the UR program:

- The item shall not be of a porous nature;
- The geometry of the item shall lend itself to survey;
- Survey results shall be documented and defendable;
- Secondary waste generation shall be minimal; and
- The level of effort to perform UR survey shall not be greater than the preparation, transportation, and disposal cost. The comparison of disposal cost versus survey cost will be performed on a case by case basis after selecting the most representative objects.

2.0 DEFINITIONS AND REFERENCES

2.1 Definitions

High Efficiency Particulate Air (HEPA) Filtered Vacuum - Vacuum unit fitted with HEPA filter with rated efficiency of 99.99% removal of particulates from exhaust.

Resource Conservation and Recovery Act (RCRA) - Listed and characteristic hazardous waste, as defined in 40 CFR 261.

Unrestricted Release - Release of material or property from administrative or regulatory control after confirming that the residual radioactivity meets the release criteria established for the project.

2.2 References

- Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors, U. S. Atomic Energy Commission, June, 1974.

- NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination, U.S. Nuclear Regulatory Commission, June, 1992.

- NUREG-1505, A Nonparametric Statistical Methodology for Design and Analysis of Final Status Decommissioning Surveys, U.S. Nuclear Regulatory Commission, August, 1995.

- NUREG-1507, Minimum Detectable Concentrations With Typical Radiation Instruments for Various Contaminants and Field Conditions, U.S. Nuclear Regulatory Commission, August, 1995.

- Environmental Chemical Corporation (ECC) Standard Operating Procedure (SOP) - R100, Instrument Calibration and Operational Check-Out.

- ECC SOP-R103, Operation of Ludlum Model 2929 W/43-10-1 Alpha/Beta Detector

- ECC SOP-R104, GM Detector Calibration and Check-Out.

- ECC SOP-R105, Proportional Detector Calibration and Check-Out.

- ECC SOP-R108, Surface Scanning.

- ECC SOP-R110, Alpha Radiation Measurement.

- ECC SOP-R111, Beta Radiation Measurement.

.

3.0 RESPONSIBILITIES

The Health Physicist (HP) is responsible for assuring that this procedure is implemented. The Health Physics Technician (HPT) is responsible for complying with the requirements of the procedure in the field.

4.0 PREREQUISITE

4.1 Materials and Equipment

The following radiation detection instrumentation should be readily accessible when performing UR surveys in the field. HPTs should select equipment that is appropriate for the type and physical limitations of the UR survey being performed. The following instruments (or equivalent) are required:

- Ludlum Model 2200 Scaler Ratemeter with Ludlum Model 43-10 Zinc Sulfide Detector;
- Ludlum Model 148-2 Multi-Smear Counter;
- Ludlum Model 2241-2 Survey Meter with Ludlum Model 43-90 100 cm^2 Zinc Sulfide Detector;
- Ludlum Model 3 Survey Meter with Ludlum Model 43-5 50 cm^2 Zinc Sulfide Detector;
- Ludlum Model 177 Ratemeter with Ludlum Model 43-5 50 cm^2 Zinc Sulfide Detector; and
- Eberline ESP-2 Scaler Ratemeter with Ludlum Model 43-20 100 cm^2 and Ludlum Model 43-68 75 cm^2 Gas Proportional Detectors.

The following detectors (or equivalent) may be used if appropriate field calibrations are performed:

- Ludlum Model 43-1, Zinc Sulfide Detector; and
- Ludlum Model 44-9 GM Pancake Detector.

The following materials should be available when performing UR surveys:

- Smears;
- Maslin cloth; and
- Appropriate UR survey forms.

4.2 Performance Check Requirements

4.2.1 Efficiency Check and Background Measurements

Prior to use of any radiation detection instrumentation, efficiency checks and background measurements will be taken. As appropriate, efficiency checks, background measurements, and determination of Minimum Detectable Activity (MDA) will be conducted and documented according to the following ECC SOPs:

- SOP-R100, Instrument Calibration and Operational Check-Out;
- SOP-R103, Alpha Scintillation Detector Calibration and Check-Out;
- SOP-R104, GM Detector Calibration and Check-Out; and
- SOP-R105, Proportional Detector Calibration and Check-Out.

4.3 Health and Safety Requirements

Personnel involved in the performance of UR surveys will comply with the requirements of the Site Safety and Health Plan (SSHP) and the Radiological Protection Program (RPP). Compliance with the requirements of the SSHP and the RPP will be verified by the Site Safety and Health Officer and the Health Physicist.

5.0 INSTRUCTION

5.1 Material Documentation Report

Materials and items selected for UR surveys will meet the criteria as defined in Sections 1.1.2 and 1.1.3. Prior to the initiation of the survey, the following will be documented under a separate report. A representative number of objects will be selected to prepare the following:

- Historical information documenting the location of the item in relation to radioactive source terms and the packaging which may have limited the potential for contamination;
- Name and description of the item;
- Decontamination method(s) to be used;
- Estimate of total effort in man-hours (for decontamination and survey);
- Estimate of volume of secondary waste which will be generated; and
- Projected cost savings of free release versus disposal, if any.

5.2 Decontamination Methods

Decontamination methods include vacuuming and wiping with maslin cloth (wet wipes). Any invasive decontamination methods will be approved by the contracting government agency.

5.2.1 Staging of Materials

- Stage materials selected for UR for initial decontamination of accessible surfaces.

- Remove residual dust and debris from accessible surfaces using a HEPA filtered vacuum unit. Care should be taken not to smear or spread dust during this activity.

- If surfaces of the item are smooth (such as the outside of a drum), wipe accessible areas with absorbent material and non-corrosive cleaning agent. The amount of waste generated from this activity should be minimized.

- Transfer the item to a low background area. If radon may be present, the item should be allowed to decay for a minimum of 4 hours when an indication of contamination present. This will allow for the decay of radon and its short lived progeny. If the activity exceeds the acceptable level, save the smear and recount in 3.8 days.

5.3 Alpha Contamination Surveys

Screening levels for alpha contamination surveys, tied to the acceptable surface contamination levels, can be determined from the following equations:

Average, total: X dpm/100 cm^2 x *E* + *Bkg* = X cpm/100cm^2
Maximum, total: X dpm/100 cm^2 x *E* + *Bkg* = X cpm/100cm^2
Removable: X dpm/100 cm^2 x *E* + *Bkg* = X cpm/100cm^2

where,

dpm = disintegration rate (disintegrations per minute),
E = counting efficiency (counts per disintegration as a fraction),
Bkg = average background count rate (counts per minute),
cpm = counts per minute, and
X = appropriate contamination limit from Table 1.

5.3.1 Total (Fixed plus Removable) Contamination Surveys

Surface contamination surveys for total (fixed plus removable) alpha contamination will be performed according to SOP-R108, Surface Scanning, and SOP-R110, Alpha Radiation Measurement.

C Place the detector face up and obtain 3 measurements, 1 minute each. This will be the background count rate for determination of the MDA in the field. If the MDA is greater than 90% of the release limit, move to an area with a lower background count rate.

C Place the detector against the surface to be measured. The probe should lie directly on the surface or no more than **2** " from the surface being measured.

C Initially, scan the item to determine if any gross contamination is present. Scanning should be done with a slow motion, with the audio on. The audio output on the scanning meter should be set to be proportional to the count rate, preferable one-to-one. Areas where the scaler or audio exceed twice background should be noted for stationary measurements.

C After initial scanning, the most elevated areas should be measured with stationary, contact readings of 30 seconds. Sufficient measurements should be taken to characterize the item as a whole. A minimum of one measurement for each 1 m^2 should be taken. The calculated acceptable background levels for different probes are presented in Attachment A.

*(**NOTE:** The surface of the detector may become contaminated during the scanning process. The instrument background should be monitored regularly and, if an elevated background level raises the MDA above 90% of the acceptable surface contamination level, then the detector should be examined for contaminants, or, if necessary, the mylar window replaced.)*

C If small areas of residual activity still remain after reasonable efforts are made to remove contaminants, contamination levels up to 3 times above the guideline for total surface contamination (when averaged over an area of 100 cm^2, Table 1) will be deemed acceptable so long as the average level within 1 m^2 does not exceed 100 dpm/100 cm^2.

5.3.2 Removable Alpha Contamination Surveys

An estimation of the total surface area should be made to determine the number of smears required. This is done by using the following equation:

$$N = SA/100\ cm^2$$

where,

N = Number of smears
SA = Surface area of the item, cm^2

Removable alpha contamination surveys will be conducted using wipe (smear) samples. The number of smears will depend upon the surface area and the potential for contamination. Because we are dealing with items of different geometry and sizes, field judgment will be used to estimate a surface area of 100 cm^2 and 1 m^2. Removable contamination surveys are to be performed according to SOP-R119, Determination of Removable Activity.

Smears on small objects less than 100 cm^2 will be taken to cover the entire surface area.

For large items, smears will be taken randomly to ensure, as a minimum, that 25% of the surface area is covered. Areas with levels above the UR limit will be decontaminated.

If greater than half of the 25% representative smears are above the UR limit, the item will be decontaminated and smear samples repeated.

Cotton swabs, or similar items, with a smear folded over the end, will be used to obtain samples from limited access locations.

5.4 Beta-Gamma Contamination Surveys

In special cases, for example when beta emission is not the primary type of emission, surveillance levels may be established by referencing the manufacturer=s instrument efficiency, and applying it to the following:

Average, total: 5000 dpm/100 cm^2 x E x (A/100)
Maximum, total: 15000 dpm/100 cm^2 x E x (A/100)
Removable: 1000 dpm/100 cm^2 x E x (A/100)

where,

dpm = disintegration rate (disintegrations/minute)
E = manufacturer=s instrument efficiency (counts/disintegration)
A = detector area (cm^2)

5.4.1 Total (Fixed plus Removable) Contamination Surveys

Surface contamination surveys for total (fixed plus removable) beta-gamma contamination will be performed according to SOP-R108, Surface Scanning, and SOP-R110, Beta Radiation Measurement.

- Place the detector face up and obtain 3 measurements, 1 minute each. This will be the background count rate for determination of the MDA in the field. If the MDA is greater than the release limit, move to an area with a lower background count rate. The MDA shall be below 90% of the acceptable limit.

- Place the detector as close as possible to the surface to be measured. The probe should lie directly on the surface or no more than 1" from the surface being measured.

- Initially, scan the item to determine if any gross contamination is present. Scanning should be done with a slow motion, with the audio on. The audio output on the scanning meter should be set to be proportional to the count rate, preferably one-to-one. Areas where the scaler or audio exceeds twice background should be noted for stationary measurements.

- After initial scanning, the most elevated areas should be measured with stationary, contact readings of 30 seconds. Sufficient measurements should be taken to characterize the item as a whole. A minimum of one measurement for each $1m^2$ should be taken.

(***NOTE:*** *The surface of the detector may become contaminated during the scanning process. The instrument background should be monitored regularly and, if an elevated background level raises the MDA above 90% of the acceptable surface contamination level, then the detector should be examined for contaminants or damage.)*

C If small areas of residual activity still remain after reasonable efforts have been made to remove contaminants, contamination levels up to 3 times above the guideline for total surface contamination (when averaged over an area of 100 $cm^{2,}$ Table 1) will be deemed acceptable as long as the average level within 1 m^2 does not exceed 1,000 dpm/100 cm^2.

5.4.2 Removable Beta-Gamma Contamination Surveys

An estimation of the total surface area should be made to determine the number of smears required. This is done by using the following equation:

$$N = SA/100\ cm^2$$

where,

N = Number of smears
SA = Surface area of the item, cm^2

Removable beta-gamma contamination surveys will be conducted using wipe (smear) samples. The number of smears will depend upon the surface area and the potential for contamination.

Smears on small objects less than 100 cm^2 will be taken to cover the entire surface area.

For large items, smears will be taken randomly to ensure a minimum of 25% of the surface area is covered. Areas with levels above the UR limit will be decontaminated.

If greater than half of the 25% representative smears are above the UR limit, the item will be decontaminated and smear samples repeated.

Cotton swabs, or similar items, with a smear folded over the end, will be used to obtain samples from limited access locations.

5.5 Unrestricted Release/Restricted Release of Material

Items which meet the Unrestricted Release criteria will be transferred to an uncontaminated area and stored for final disposal or transfer to the owner. Items will be marked or tagged to indicate the status of the item.

Items which do not meet the Unrestricted Release criteria will be staged for packaging, transportation, and disposal to a permitted LLRW facility.

6.0 DOCUMENTATION AND RECORDS

6.1 Documentation

Document the results of the survey on the UR Survey Form. Minimum documentation includes:

- C Date of survey;
- C HPT performing the survey;
- C Identification of the item (include a sketch or photograph of the item);
- C Instrumentation;
- C Instrumentation calibration dates;
- C Instrumentation background and efficiency;
- C Location of survey measurements;
- C Historical information and/or process knowledge (as necessary to clarify results);
- C Estimated total surface of item (as necessary - if inaccessible areas are present and suspected to be contaminated);
- C Decontamination efforts; and
- C Final disposition of the item.

6.2 Records

Documented survey results will be given to the Site Health Physicist. The Site HP will review documentation and file for retrial during the project. Final disposition of the surveys will be dependant upon the contracting government agency.

ATTACHMENT A

Maximum background levels were calculated for different probes using their area, average efficiency, and 30 second count times. They were calculated from the formula for MDA = 90 dpm/100 cm^2.

$$MDA = \frac{2.71 + 4.65\sqrt{B_R \times t}}{t \times E \times \frac{A}{100}}$$

The calculations are based on the assumption that the MDA is above 90% of the average acceptable level for direct survey of 100 dpm/100 cm^2 for a 30 second counting time. The following equation was used to calculate β (cpm/100 cm^2):

$$\mathbf{b} < \frac{90 \times \text{Eff.} \times \text{Area}}{2162} - \frac{0.125}{30}$$

Detector Model	Efficiency	Area	Count Time	b
43-1	20%	75 cm^2	30 seconds	<0.62 cpm/100 cm^2
43-5	12%	50 cm^2	30 seconds	<0.24 cpm/100 cm^2
43-89	20%	100 cm^2	30 seconds	<0.83 cpm/100 cm^2
43-90	20%	100 cm^2	30 seconds	<1.19 cpm/100 cm^2
43-20	20%	143 cm^2	30 seconds	<1.19 cpm/100 cm^2
43-68	20%	100 cm^2	30 seconds	<0.83 cpm/100 cm^2

ECC, SOP-R400
MISCELLANEOUS SAMPLING

1.0 PURPOSE

To discuss methods for collecting miscellaneous samples which may require intrusive sampling techniques.

2.0 RESPONSIBILITIES

The site health physicist is responsible for assuring that this procedure is implemented. Survey team personnel are responsible for following this procedure.

3.0 EQUIPMENT

Equipment is chosen based on the type of material to be sampled. The following list represents some possibilities:

- Paint sampling heat gun, paint stripper solution, chisel and hammer.
- Drains or pipes-plumber's snake, swabs - for drains or pipes.
- Residues-trowels, scoops.
- Concrete or asphalt-core bores, hammer and chisel - for concrete asphalt.

4.0 PROCEDURE

4.1 Methods for collecting miscellaneous samples should be determined based on the characteristics of the sample media. Care should be taken to limit the potential for spreading contamination during sample collection.

Sample quantities should be determined based on the following:

- Type of analyses required
- Number of analyses to be requested
- Detection sensitivity required of analytical result

- C Estimated activity level of material

4.2 Label and secure all samples in accordance with SOP-R121 the chain-of-custody procedure in the Quality Assurance Manual. Record pertinent information on the Miscellaneous Sampling Measurement and Chain-of-Custody Record Forms.

CHAIN-OF-CUSTODY RECORD

Site ____ Sample Type ____________________

Samplers ____

NOTE: If more than one name is listed, circle the sample custodian.

Sample Number	Sampling Location	Collected		Remarks
		Date	Time	

Transport Method ____ Seal No. __________________________

1. Relinquished by:	Date	Time	*Received in good condition by:
2. Relinquished by:	Date	Time	*Received in good condition by:
3. Relinquished by:	Date	Time	*Received in good condition by:
4. Relinquished by:	Date	Time	*Received in good condition by:

*For samples received in unacceptable condition explain in Remarks Column.

j:\belding\talbe\chain.vsd

MISCELLANEOUS SAMPLE RECORD FORM

Site ______________________

Area ______________________
____
____

Date ______________________

Surveyor(s) ______________________
____

Type	Instrument	Detector		BKG. (cpm)	EFF.

Location	Direct Detector Measurements				Sample Type	Sample Number	Remarks
	Type:		Type:				
	c/____m	dpm/100cm²	c/____m	dpm/100cm²			

SOP-R400, REV0

Calculations By: ______________________ Date: ______________ ☐ Data Reviewed ☐ Calculations Reviewed

j:\belding\table\missamp.vsd

ECC, SOP-R401
SAMPLE HANDLING AND CUSTODY REQUIREMENTS

A sample is physical evidence collected from a site or facility. Due to the possible evidentiary nature of the samples collected during enforcement investigations, a stringent program of custody procedures will be utilized to assure that each sample is accounted for from the time of collection to analysis. To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory, documentation in logbooks and a chain-of-custody record will be employed.

Every sample will be given a unique field sample designation for identification purposes.

1.0 Sample Designation

Sampling locations will be numbered sequentially and a sketch provided showing sample numbers and their corresponding locations. The numbering system for the sampling locations will be coordinated with the on-site representative and the Project Manager or Project Engineer, to ensure that the proposed sample identifiers are discrete. The sample identification will be a numerical sequence with a prefix designating a project code, a site area designation, the sampling date, and the designated sample number with a two-letter suffix indicating the sample matrix (i.e., MW-monitoring well, SW-surface water, SL-soil, and BR-bedrock).
For example: sample No. 4915-CWP-0595-23SL indicates that the sample was

- collected for Project No.4915
- from the CWP area
- on May, 1995
- sample 23, a soil sample.

All logbooks, sample labels, custody seals, representative sampling documents, and chain-of-custody documents are completed using these sample designations.

2.0 Sample Label

A sample label will be attached to each sample container. The label will contain the following information:

Project Code:	
Sample No.:	As designated in Figures or in notebook
Date:	Date sample is collected
Time:	Time sample is collected (24-hour clock)
Sampler(s):	Signature(s) of sampler(s)

Preservative:	Identify type
Analysis:	Identify analysis
Remarks:	Note if radiation

3.0 Custody Seal

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures. Due to the evidentiary nature of the samples collected, possession must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. The custody seal will be attached to the outside of each sample container in such a manner that it is necessary to break it in order to open the container. The following information will be written on the custody seal:

Sample number
Date
Signature of sampler(s)
Name and title of sampler(s) - printed

4.0 Sample Custody

A sample is considered under custody if:

1. It is in your possession.
2. It is in your view after being in your possession
3. It was in your possession and then locked up or placed in a sealed container to prevent tampering.
4. It is in a designated secure area.

5.0 Chain-of-Custody Record

All sample shipments will be accompanied by the chain-of-custody record identifying its contents. The original custody record is shipped along with the samples, while the initiator of the record retains a copy. The chain-of-custody record ensures that samples can be traced from the time of field collection until they have been received and analyzed by an analytical or geotechnical laboratory so that the analysis may be used as evidence in legal proceeding.

When responsibility of a group of samples changes several times, each custodian is not required to retain a copy of the custody record, as long as the original custody record indicates that each person accepting the samples has subsequently relinquished custody appropriately. Chain-of-custody forms will be completed according to the following protocol:

C The originator fills in all requested information from the sample labels.

- The originator signs the "Relinquished by" box and keeps the copy.
- The original record sheet is shipped with the samples. A plastic shipping envelope will be taped to the inside of the cooler top and the remaining two copies of the chain-of-custody will be inserted along with the Representative Sampling Documents.
- The person receiving custody checks the sample label information against the custody record. He/she also checks sample condition and notes anything unusual under "Remarks" on the custody form.
- The person receiving custody signs in the adjacent "Received by" box and keeps the original.
- The Date/Time will be the same for both signatures, since custody must be transferred between two individuals. However, when samples are shipped via common carrier (e.g. Federal Express), the date/time will not be the same for both signatures.
- When samples are shipped via common carrier, the original custody form is shipped with the samples and the shipper (e.g. Field Sample Custodian) keeps the copy. The shipper also keeps all shipping paper, bills of lading, etc.
- In all cases, it must be readily seen that the person receiving custody has relinquished it to the next custodian.
- If samples are left unattended or a person refuses to sign, this must be documented and explained on the custody record.

6.0 Representative Sample Document

A representative sample document will be completed for each sample collected. The representative sample document records the complete history of each sample, including the sample source, date collected, sample methodology, sample size and container, sample number, and the analysis required. This document is signed by the sampler and a witness and remains with the project records.

ECC, SOP-R402
SOIL SAMPLING

1.0 PURPOSE

To describe the procedures for collecting samples of surface soil potentially contaminated with radioactive nutrients.

2.0 RESPONSIBILITIES

The site health physicist is responsible for assuring that this procedure is implemented. Survey team personnel are responsible for following this procedure.

3.0 EQUIPMENT

C Digging implement: garden trowel, shovel, spoons, post-hole digger, etc.

C Special sampling apparatus (cup cutter, shelby tube, etc.) as required.

C Plastic bags, approximately 10 cm diameter x 30 cm long.

C Cardboard Aice cream@ containers (1 quart size) or geology sample bags.

C Twist-ties.

C Masking tape.

C Record forms and/or logbook.

C Labels and security seals.

C Indelible pen.

C Equipment cleaning supplies, as appropriate.

4.0 PROCEDURE

NOTE: Because standard surface soil contamination criteria for radionuclides are applicable to the average concentration in the upper 15 cm of soil, the usual sampling protocol described here is based on obtaining a sample of this upper 15 cm. Special situations, such as to evaluate trends or airborne deposition, determining near-surface contamination profiles, and measuring non-radiological contaminants, necessitate special sampling procedures. These special situations are evaluated and incorporated into site-specific survey plans as the need arises.

Direct surface and 1-meter gamma radiation measurements may be performed at each location before initiating sampling. This will identify the presence of gross radionuclide contamination which will require special handling and equipment cleanup procedures. If contamination is suspected, a beta-gamma Aopen@ and Aclosed@ measurement may also be desired before sampling begins.

4.1 Loosen Soil

Loosen the soil at the selected sampling location to a depth of 15 cm, using a trowel or other digging implement.

4.2 Screen Soil

Remove large rocks, vegetation, and foreign objects (these items may also be collected as separate samples, if appropriate.)

4.3 Collecting Samples

Place approximately 1 kg of this soil into a plastic bag-lined cardboard container or geology sample bag. If it is not possible to reach a depth of 15 cm using a hand tool (i.e. trowel or shovel) 1 kg of soil should be collected from the accessible depth. The actual depth should be recorded on the sample container and the data form. Seal the bag using a twist-tie, cap, and tape the cap in place (or tie the sample bag strings).

4.4 Sample Labeling

Label and secure the sample container in accordance with SOP-R121 and the chain-of-custody procedures in the Quality Assurance Manual. Record pertinent information on the Chain-of-Custody Form (ECC).

4.5 Logbook

Record sample identification, location, and other pertinent data (such as discoloration of soil, and particle size) on appropriate record forms, maps, drawings, and/or site logbook.

4.6 Subsurface Sampling

If the location has been identified as having elevated activity, a measurement should be obtained after the sample is collected to determine the possibility of contamination at a depth greater than 15 cm. If a subsurface sample is deemed necessary, refer to SOP-R114.

> NOTE: Contact the site coordinator if the exposure rate measurement exceeds the capability of the instrumentation available on site. The detector can be temporarily shielded by using a collimated lead layer to prevent shine from diffused sources, other anomalies such as hot spot identification must always be noted in the field logbook.

4.7 Decontamination

Clean sampling tools, as specified in the decontamination SOP, before proceeding to the next sampling location in accordance with instructions available on-site.

4.8 Quality Control Samples

Perform quality control sampling as required in the ECC Quality Assurance Manual.

SYSTEMATIC/RANDOM SURFACE MEASUREMENTS

Surveyor(s)

Site ______________________ ______________

Area ______________________ _____________

Date _____________________ ______________

Type	Instrument	Detector	Back-Ground	Effi-ciency

	Scintillation			GM			
	1 meter		Contact	Open	Closed		
Location	Kcpm	: R/hr	Kcpm	c/___m	c/___m	Soil Sample	Remarks
QC*							
QC*							

*Quality Control Samples

Remarks: ____

____

Calculations by: _______________________

Date: ________________________________

j:\belding\table\sysrando.vsd

☐ Data Reviewed

☐ Calculations Reviewed

BIAS SURFACE MEASUREMENTS

Surveyor(s)

Site ______________________ ______________

Area ______________________ _____________

Date _____________________ ______________

Type	Instrument	Detector	Back-Ground	Effi-ciency

Location	Scintillation			GM		Soil Sample	Estimated Area of Elevated Activity
	1 meter		Contact	Open	Closed		
	Kcpm	: R/hr	Kcpm	c/___m	c/___m		

Remarks: ____

____

Calculations by: ______________________

Date: ______________________________

Data Reviewed

Calculations Reviewed

j:\belding\table\biassur.vsd

CHAIN-OF-CUSTODY RECORD

Site ____ Sample Type ____________________

Samplers ____

NOTE: If more than one name is listed, circle the sample custodian.

Sample Number	Sampling Location	Collected		Remarks
		Date	Time	

Transport Method ____ Seal No. __________________________			
1. Relinquished by:	Date	Time	*Received in good condition by:
2. Relinquished by:	Date	Time	*Received in good condition by:
3. Relinquished by:	Date	Time	*Received in good condition by:
4. Relinquished by:	Date	Time	*Received in good condition by:

*For samples received in unacceptable condition explain in Remarks Column.

j:\belding\talbe\chain.vsd

ECC, SOP-R403
SUBSURFACE SOIL SAMPLING

1.0 PURPOSE

To describe the procedure for collecting samples of subsurface soil potentially contaminated with radioactive materials.

2.0 RESPONSIBILITIES

The site health physicist responsible for assuring that this procedure is implemented. Survey team personnel are responsible for following this procedure.

3.0 EQUIPMENT

C Digging implement: garden trowel, shovel, spoons, post-hole digger, etc.

C Special sampling apparatus (cup cutter, shelby tube, etc.) as required.

C Plastic bags, approximately 10 cm diameter x 30 cm long.

C Trowel or spatula.

C Cardboard Aice cream@ containers (1 quart size) or geology sample bags.

C Twist-ties.

C Masking tape.

C Large rubber bands.

C Record forms, and/or logbook.

C Labels and security seals.

C Indelible pen.

C Equipment cleaning supplies, as appropriate.

4.0 PROCEDURE

4.1 General

4.1.1 When direct radiation measurements are required (surface and borehole logging) they are to be performed prior to sample collection in order to identify the presence of gross radionuclide contamination requiring special handling or cleanup (see SOP-R113 and R114).

4.1.2 When a borehole fills with water and a water sample is desired refer to the subsurface water sampling procedure in SOP-R116.

NOTE: Special considerations, such as those described for surface sampling, may require deviations from this procedure. These will be described in the site-specific survey plan as the need arises.

4.2 Systematic Subsurface Sampling (Option 1)

This procedure is applicable to depths of approximately 3 m when boreholes or trenches which have been dug and remain uncollapsed and are free of water.

NOTE: If borehole logging is to be done it should be completed before sampling begins.

4.2.1 Place a plastic bag liner into the downhole sampler and secure with a large rubber band.

4.2.2 Lower the sampling tool to the desired depth in the borehole or trench.

4.2.3 Scrape the inside borehole or trench wall with the toothed edge of the tool until approximately 1 kg of sample is collected.

4.2.4 Transfer the plastic bag and sample into container.

4.2.5 Seal the bag using a twist-tie, cap, and tape the cap in place (or tie sample bag ties).

4.2.6 Label and secure the sample container in accordance with SOP-R121 and the chain-of-custody procedures in the Quality Assurance Manual. Record pertinent information on the Chain-of-Custody Form.

4.2.7 Record sample identification, location, depth, and other pertinent data on the appropriate record forms, map, drawing, and/or site logbook.

4.2.8 Clean sampling tools, as necessary, before proceeding with further sample collection, in accordance with instructions in the Decontamination SOP.

4.3 Systematic Subsurface Sampling (Option 2)

Procedures applicable to depths exceeding 3 m and in boreholes where walls do not remain intact or that fill with water.

4.3.1 Drill the borehole to the desired sampling depth using an auger.

4.3.2 Drive a split-spoon or shelby tube collector beyond the augered depth. The driving distance should be 30 to 60 cm.

4.3.3 Withdraw the collecting device and remove the collected core.

4.3.4 Place the entire core, or a potion of the core, into a plastic bag-lined cardboard container or geology sample bag. (The core may be split into multiple segments, representing different sampling depths.)

4.3.5 Repeat steps 4.2.5 to 4.2.8.

4.4 Biased Subsurface Sampling

Procedures applicable when a surface sample has been collected and radiation levels are still sufficiently above background as to require further investigation at the location.

4.4.1 Using a shovel or post-hole diggers, collect 1 kg of the next 15 cm of soil.

4.4.2 Seal the bag using a twist-tie, cap, and tape the cap in place (or tie sample bag ties).

4.4.3 Label and secure the sample container in accordance with SOP-R121 and the chain-of-custody procedures in the Quality Assurance Manual. Record pertinent information on the Chain-of-Custody Form.

4.4.4 Record sample identification, location, depth, and other pertinent data on the appropriate record form, map, drawing, and/or site logbook.

4.4.5 Clean sampling tools, as necessary, before proceeding with further sample collection, in accordance with instructions in the Decontamination SOP.

4.4.6 Monitor the sample hole to determine activity level. If the activity level is still elevated, repeat items 4.4.1-4.4.6. If the activity level has dropped to background, record the measurement and monitor the area, including personnel and equipment, to determine the extent of decontamination that may be necessary.

SYSTEMATIC/RANDOM SURFACE MEASUREMENTS

Site ______________________ Surveyor(s) ______________

Area ______________________ ______________

Date ______________________ ______________

Type	Instrument	Detector	Back-Ground	Effi-ciency

Location	Scintillation			GM		Soil Sample	Remarks
	1 meter		Contact	Open	Closed		
	Kcpm	: R/hr	Kcpm	c/___m	c/___m		
QC*							
QC*							

*Quality Control Samples

Remarks: ____

____

Calculations by: ________________________ ☐ Data Reviewed ☐ Calculations Reviewed

Date: ________________________________

j:\belding\table\sysrando.vsd

SOP-R403, REV0

BIAS SURFACE MEASUREMENTS

Surveyor(s)

Site ______________________ ______________

Area ______________________ _____________

Date _____________________ ______________

Type	Instrument	Detector	Back-Ground	Effi-ciency

Location	Scintillation			GM		Soil Sample	Estimated Area of Elevated Activity
	1 meter		Contact	Open	Closed		
	Kcpm	: R/hr	Kcpm	c/___m	c/___m		

Remarks: ____

____

Calculations by: ______________________

Date: ______________________________

Data Reviewed

Calculations Reviewed

j:\belding\table\biassur.vsd

CHAIN-OF-CUSTODY
BOREHOLE LOGGING AND SAMPLING
RECORD

Site ____ Surveyor(s) ___________________________

Area ____

Site ____ ________ Sample Type ____________________

Date ____

Samplers ____

Grid Location/Hole No. ________________________________

NOTE: If more than one name is listed, circle the sample custodian.

Hole Casing Type ___________________________________

Depth to Water ____________________________________

Water Sample I.D. __________________________________

Type	Instrument	Detector
	Remarks	

Sample Number	Sampling Location	Collected Date	Collected Time	Remarks

Depth	Measurement c/______ m	Soil Sample	Remarks

Transport Method ____ Seal No. ___________________________

Relinquished by	Date	Time	*Received in good condition by
1. Relinquished by:	Date	Time	*Received in good condition by:
2. Relinquished by:	Date	Time	*Received in good condition by:
3. Relinquished by:	Date	Time	*Received in good condition by:
4. Relinquished by:	Date	Time	*Received in good condition by:

Remarks: ____

____

~~j:\belding\table\borehole.vsd~~

*For samples received in unacceptable condition explain in Remarks Column.

j:\belding\talbe\chain.vsd

ECC, SOP-R804
Radiological Material Loading & Shipping

1.0 PURPOSE

The Radiological Material Loading process is intended to assure that the loading of any radiologically contaminated soil/debris will adhere to the applicable regulations in 10 CFR 20 and 49 CFR. Additionally, the overall goal of the procedure is to adequately package and survey material for the safe transport to its destination.

1.1 Loading Procedures

Bulk radioactive contaminated material will be loaded into intermodals at the Li Tungsten and transported to the appropriate disposal facility. ECC will inspect all intermodals prior to use to ensure vehicle integrity. Loading procedures are discussed in the following sections.

1.2 Loading Procedures for Trucks

The intermodals will be loaded at the staging area that will be lined with six (6) mil plastic sheeting. The sheeting will be replaced as needed and disposed of with the soil. Any material spilled onto the asphalt surface will be immediately cleaned up and the area surveyed "radiologically clean". The intermodals will be filled below the water level capacity of the intermodals and covered with a form fitted tarpaulin that will be bungee corded to the intermodal body. The tarpaulin may be secured with more aggressive methods if the bungle cord is inadequate. The intermodals will be inspected for water tightness. Intermodals will be loaded in accordance with the selected disposal facilities waste acceptance criteria.

The intermodals and trucks will be subjected to a radiological survey to ensure they are "radiologically clean" prior to traveling on public roadways. These survey results will be documented and retained in the site project records.

Each tri-axle truck will be placarded and/or labeled per DOT requirements and have a Bill of Lading and a Low Level Radiological Waste (LLRW) manifest. The LLRW manifests will be completed by the Project Health Physicist (PHP). While driving, each truck driver will be accompanied by documentation certifying completion of the required radiation safety training. Drivers will be supplied with radios for communications with Li Tungsten. Spill kits will be present in each truck with emergency instructions for the truck drivers to be used in case of an emergency. The spill kits will be located behind the driver's side seat and will contain at least the following equipment:

- Plastic sheeting;
- Rope;

- Half face respirator and cartridges;
- Personal protective equipment including gloves, booties, tyvek suits, etc.;
- Paper towels or other absorbent material; and
- A flat bottom shovel and Rad bags.

A radiological survey will be performed and documented in the areas of intermodal loading and unloading twice a day to investigate contamination levels at the point of loading/unloading. If the survey results confirm the absence of contamination, the area will be considered clean. Trucks and intermodals being loaded or unloaded in a clean area will have a gross area smear survey performed on those areas most likely to become radiologically contaminated (i.e., top of dump bed, tires). The results of these surveys will be compared to release levels presented in the following table

Table 2
Acceptable Surface Contamination Levels

Nuclide [a]	**Average** [bc] **dpm/100 cm^2**	**Maximum** [bd] **dpm/100 cm^2**	**Removable** [ba] **dpm/100 cm^2**
U-238, U-nat, U-235, and associated decay products	5,000	15,000	1,000
Ra-226, Transuranics, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I129	100	300	20
Th-232, Th-nat, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 -	15,000 -	1,000 -

a Where surface contamination by both alpha-and beta-gamma- emitting nuclides exists, the limits established for alpha- and Beta-gamma-emitting nuclides should apply independently.

b As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive materials as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

c Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each object.

d The maximum contamination level applies to an area of not more tan 100 cm2.

e The amount of removable radioactive material per 100 cm2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

If the results are greater than release levels, decontamination procedures will be enforced. After decontamination, smears of the tires and bed will be taken and the results compared to the release criteria and DOT limits. The loading/unloading areas will be decontaminated after each finding of removable activity levels above release criteria. The loading/unloading areas will then be surveyed. Trucks and intermodals will also have dose rate surveys performed to determine surface and one meter dose rates to determine Transport Indexes in accordance with 49 CFR 173.403.

1.3 Labeling/Placarding

ECC will identify all waste codes applicable to each hazardous waste stream based on requirements in 40 CFR 261 or any applicable State or local law or regulation.

ECC will provide primary and subsidiary labels for hazardous materials/wastes consistent with the requirements in the Hazardous Materials Table in 49 CFR 172, Section 101, Column 6. Labels will meet designs specifications required by 49 CFR 172, Subpart E including size, shape, color, printing, and symbol requirements. Labels will be durable and weather resistant for a 180 day exposure period.

For each off-site shipment of hazardous material/waste, ECC will provide primary and subsidiary placards consistent with the requirements of 49 CFR 172, Subpart F. Placards will be provided for each side and each end of the transport vehicles requiring such placarding. Placards may be plastic, metal, or other material capable of withstanding, without deterioration, a 30 day exposure to open weather conditions and will meet design requirements specified in 49 CFR 172, Subpart F.

1.3.1 Classification of Shipment and Labeling/Placarding of Shipments

Classification of loaded intermodals for Li Tungsten requires radioisotope activity levels and the weight of the shipment. Activity levels for each radionuclide chain for Li Tungsten (U-238, Ra-226, and Th-232) will be documented for the shipment. Using the weight of the intermodal, a calculation will be performed to classify the shipment as a Class 7, Class 9, or other shipment. A Class 7 (Radioactive) shipment of soil would exceed 2000 pCi/g. A Class 9 shipment of soil would exceed a Reportable Quantity (RQ), but not exceed 2000 pCi/g. If a shipment of soil is neither a Class 7 or 9, the shipment will be classified as EPA Non-Hazardous.

If a shipment of the Li Tungsten contaminated soil would contain a reportable quantity, the loaded waste is considered an "Environmentally Hazardous Substance" and will be described in the manifest as "Environmentally hazardous substance, solid, n.o.s., 9, UN 3077, III, RQ, (Radionuclides)" [49 CFR 172.203(c)(2)]. Domestic shipments of Class 9 materials are not required to be placarded; however, it is permissible to placard as Class 9, if desired. Once the determination is made to placard, bulk shipments of Class 9 materials must be marked on each side and each end with the appropriate identification number (in this case, 3077) displayed on a Class 9 placard, an orange panel, or a white square-on-point display as described in [49 CFR 172.504(f)(9)].

If packaged material is classified as a Class 7 shipment (greater than 2000 pCi/g) the material will be classified as Class 7 "Radioactive" and placarded accordingly. The loaded waste will be described in the manifest as "Radioactive Material, LSA-I, solid, n.o.s., UN 2912".

2.0 Vehicle Release Criteria

When exiting the Li Tungsten, the trucks carrying the intermodals will stop at the boundary of the CRZ and verification surveys will be conducted and documented. The trucks will be weighed using a certified truck scale prior to accessing public highways and to assist in the calculation and manifesting of weight in the load. The truck drivers will obtain a weigh bill and straight bill of lading and LLRW manifest will be generated to accompany the shipment to the appropriate disposal facility. A check list (Appendix A) will be completed for each truck prior to vehicle release indicating that the truck contains all necessary documentation, labeling, and placarding requirements.

The intermodal containers and the trucks will be surveyed and released in accordance with the following guidelines. The release criteria selected are those generally used by the Department of Transportation, 49 CFR 173.443, Table 11 Non-fixed External Radioactive Contamination Wipe Limits for Transportation of Radioactive Materials

3.0 Contaminant Maximum Permissible Limits

	Bq/cm^2	$\mu Ci/cm^2$	dpm/cm^2
β,γ and low toxicity α emitters	0.4	10 E-5	22
All other α emitting radionuclides	.04	10 E-6	2.2

Surface contamination wipe samples will be compared to the “all other alpha emitting radionuclides” guidelines. If the surface contamination wipe sample results are greater than release levels, then further decontamination will be performed. After decontamination, smears of the tires and container beds will be taken and the results compared to the release criteria and DOT limits. The loading/unloading areas will be decontaminated after each finding of removable activity levels above release criteria and surveyed. Trucks and intermodals will also have dose rate surveys performed to determine surface, and one meter dose rates to determine Transport Indexes in accordance with 49 CFR 173.403.

4.0 Shipping Papers

Before release of trucks, shipping papers will be prepared. Contaminated soil will be characterized.

This data will be used to determine the DOT classification of the material being shipped. Shipping papers will included a Bill of Lading and a Low Level Radioactive Waste Manifest.

4.1 Bill of Lading

Intermodals will be shipped to the disposal facility using a bill of lading and a Low Level Radioactive Waste Manifest as the shipping documents. These documents will satisfy the requirements of 49 CFR 172, Subpart C.

4.2 Uniform Low-Level Radioactive Waste Manifest

The results of the sample counting, weights and results of the radiological surveys will be used to determine the correct DOT classification that will be input into the Low-Track© system for preparing a Uniform Low-Level Radioactive Waste Manifest meeting the requirements of NUREG/BR-0204, Rev.2 as required by the disposal facility.

5.0 Instrumentation

The following radiation detection instrumentation should be readily accessible when performing vehicle surveys in the field. The following instruments (or equivalent) may be required:

- Ludlum Model 2200 Scaler Ratemeter with Ludlum Model 43-10 Zinc Sulfide Detector;
- Ludlum Model 148-2 Multi-Smear Counter;
- Ludlum Model 2241-2 Survey Meter with Ludlum Model 43-90 100 cm^2 Zinc Sulfide Detector;
- Ludlum Model 19 Micro R Meter;
- Ludlum Model 177 Ratemeter with Ludlum Model 43-5 50 cm^2 Zinc Sulfide Detector; and

The following detectors (or equivalent) may be used if appropriate field calibrations are performed:

- Ludlum Model 43-1, Zinc Sulfide Detector; and
- Ludlum Model 44-9 GM Pancake Detector.

The following materials should be available when performing Vehicle Release surveys:

- Smears;
- Maslin cloth; and
- Appropriate vehicle release survey forms.

5.1.1 Efficiency Check and Background Measurements

Prior to use of any radiation detection instrumentation, efficiency checks and background measurements will be taken. As appropriate, efficiency checks, background measurements, and determination of Minimum Detectable Activity (MDA) will be conducted and documented according to the following ECC SOPs:

- SOP-R100, Instrument Calibration and Operational Check-Out;
- SOP-R103, Alpha Scintillation Detector Calibration and Check-Out; and
- SOP-R104, GM Detector Calibration and Check-Out

6.0 Health and Safety Requirements

Personnel involved in the performance of vehicle release surveys will comply with the requirements of the Site Safety and Health Plan (SSHP) and the Radiological Protection Program (RPP). Compliance with the requirements of the SSHP and the RPP will be verified by the Site Safety and Health Officer and the Health Physicist.

6.1 Alpha Contamination Surveys

Screening levels for alpha contamination surveys, tied to the acceptable surface contamination levels, can be determined from the following equations:

Average, total: X dpm/100 cm^2 x E + Bkg = X cpm/100cm^2
Maximum, total: X dpm/100 cm^2 x E + Bkg = X cpm/100cm^2
Removable: X dpm/100 cm^2 x E + Bkg = X cpm/100cm^2

where,

dpm = disintegration rate (disintegrations per minute),
E = counting efficiency (counts per disintegration as a fraction),
Bkg = average background count rate (counts per minute),
cpm = counts per minute, and
X = appropriate contamination limit from Table 1.

6.1.1 Total (Fixed plus Removable) Contamination Surveys

Surface contamination surveys for total (fixed plus removable) alpha contamination will be performed according to SOP-R108, Surface Scanning, and SOP-R110, Alpha Radiation Measurement.

C Place the detector face up and obtain 3 measurements, 1 minute each. This will be the background count rate for determination of the MDA in the field. If the MDA is greater than 90% of the release limit, move to an area with a lower background count rate.

C Place the detector against the surface to be measured. The probe should lie directly on the surface or no more than **2**" from the surface being measured.

C Initially, scan the item to determine if any gross contamination is present. Scanning should be done with a slow motion, with the audio on. The audio output on the scanning meter should be set to be proportional to the count rate, preferable one-to-one. Areas where the scaler or audio exceed twice background should be noted for stationary measurements.

C After initial scanning, the most elevated areas should be measured with stationary, contact readings of 30 seconds. Sufficient measurements should be taken to characterize the item as a whole. A minimum of one measurement for each 1 m^2 should be taken. The calculated acceptable background levels for different probes are presented in Attachment A.

*(**NOTE:** The surface of the detector may become contaminated during the scanning process. The instrument background should be monitored regularly and, if an elevated background level raises the MDA above 90% of the acceptable surface contamination level, then the detector should be examined for contaminants, or, if necessary, the mylar window replaced.)*

C If small areas of residual activity still remain after reasonable efforts are made to remove contaminants, contamination levels up to 3 times above the guideline for total surface contamination (when averaged over an area of 100 cm^2, Table 1) will be deemed acceptable so long as the average level within 1 m^2 does not exceed 100 dpm/100 cm^2.

6.1.2 Removable Alpha Contamination Surveys

An estimation of the total surface area should be made to determine the number of smears required. This is done by using the following equation:

$$N = SA/100\ cm^2$$

where,

N = Number of smears
SA = Surface area of the item, cm^2

Removable alpha contamination surveys will be conducted using wipe (smear) samples. The number of smears will depend upon the surface area and the potential for contamination. Because we are dealing with items of different geometry and sizes, field judgment will be used to estimate a surface area of 100 cm^2 and 1 m^2. Removable contamination surveys are to be performed according to SOP-R119, Determination of Removable Activity.

6.2 Beta-Gamma Contamination Surveys

In special cases, for example when beta emission is not the primary type of emission, surveillance levels may be established by referencing the manufacturer's instrument efficiency, and applying it to the following:

Average, total: 5000 dpm/100 cm^2 x E x (A/100)
Maximum, total: 15000 dpm/100 cm^2 x E x (A/100)
Removable: 1000 dpm/100 cm^2 x E x (A/100)

where,

dpm = disintegration rate (disintegrations/minute)
E = manufacturer's instrument efficiency (counts/disintegration)
A = detector area (cm^2)

6.2.1 Total (Fixed plus Removable) Contamination Surveys

Surface contamination surveys for total (fixed plus removable) beta-gamma contamination will be performed according to SOP-R108, Surface Scanning, and SOP-R110, Beta Radiation Measurement.

- Place the detector face up and obtain 3 measurements, 1 minute each. This will be the background count rate for determination of the MDA in the field. If the MDA is greater than the release limit, move to an area with a lower background count rate. The MDA shall be below 90% of the acceptable limit.

- Place the detector as close as possible to the surface to be measured. The probe should lie directly on the surface or no more than 1" from the surface being measured.

- Initially, scan the item to determine if any gross contamination is present. Scanning should be done with a slow motion, with the audio on. The audio output on the scanning meter should be set to be proportional to the count rate, preferably one-to-one. Areas where the scaler or audio exceeds twice background should be noted for stationary measurements.

- After initial scanning, the most elevated areas should be measured with stationary, contact readings of 30 seconds. Sufficient measurements should be taken to characterize the item as a whole. A minimum of one measurement for each $1m^2$ should be taken.

  (***NOTE:*** *The surface of the detector may become contaminated during the scanning process. The instrument background should be monitored regularly and, if an elevated background level raises the MDA above 90% of the acceptable surface contamination level, then the detector should be examined for contaminants or damage.)*

6.2.2 Removable Beta-Gamma Contamination Surveys

An estimation of the total surface area should be made to determine the number of smears required. This is done by using the following equation:

$N = SA/100\ cm^2$

where,

N	=	Number of smears
SA	=	Surface area of the item, cm^2

Removable beta-gamma contamination surveys will be conducted using wipe (smear) samples. The number of smears will depend upon the surface area and the potential for contamination.

7.0 DOCUMENTATION AND RECORDS

7.1 Documentation

Document the results of the survey on the Vehicle Release Survey Form. Minimum documentation includes:

- Date of survey;
- HPT performing the survey;
- Identification of the intermodal;
- Instrumentation;
- Location of survey measurements;
- Survey Results

7.2 Records

Documented survey results will be given to the Site Health Physicist. The Site HP will review documentation and file for retrial during the project.

8.0 RESPONSIBILITIES

The Health Physicist (HP) is responsible for assuring that this procedure is implemented. The Health Physics Technician (HPT) is responsible for complying with the requirements of the procedure in the field.

VEHICLE RELEASE FORM

Project: ________________________________ Project Number: _____________________
Date: __________________________________ Time:______________________________

Vehicle Type: ___________________________ Vehicle No.: ________________________

Direct Alpha Survey

Instrument: Model #: _______________________
Serial #: _______________________
Calibration Due Date: ______________________

Release Limit: ______________________________
Instrument Background: ______________________
Efficiency: _________________________________
Max on Contact: _____________________________

Location:____________________________________

Max for Release: ____________________________

Survey Readings: ____________________________
(Units)

Cab: ________________________________
Tires: _______________________________
Sides: _______________________________
Tailgate: _____________________________
Cab Roof: ____________________________

Other: _______________ __________________
(Location) (Reading)

Exiting Truck Checklist

Tailgate Secured: ____________________
(Initials)

Tarp and Tie Downs
Secured: ______________________________
(Initials)

Radio/Cell Phone: _____________________
(Initials)

Spill Kit: ______________________________
(Initials)

Permits/Licenses: ______________________
(Initials)

Full Trucks Only

Shipping Papers: ______________________
(Initials)

Certified Weight Slip: __________________
(Initials)

Contact Gamma Survey

Instrument: Model# : __________________________
Serial #: __________________________

Release Limit: ________________________________

Max Contact Reading: __________________________

Released for Highway Transport

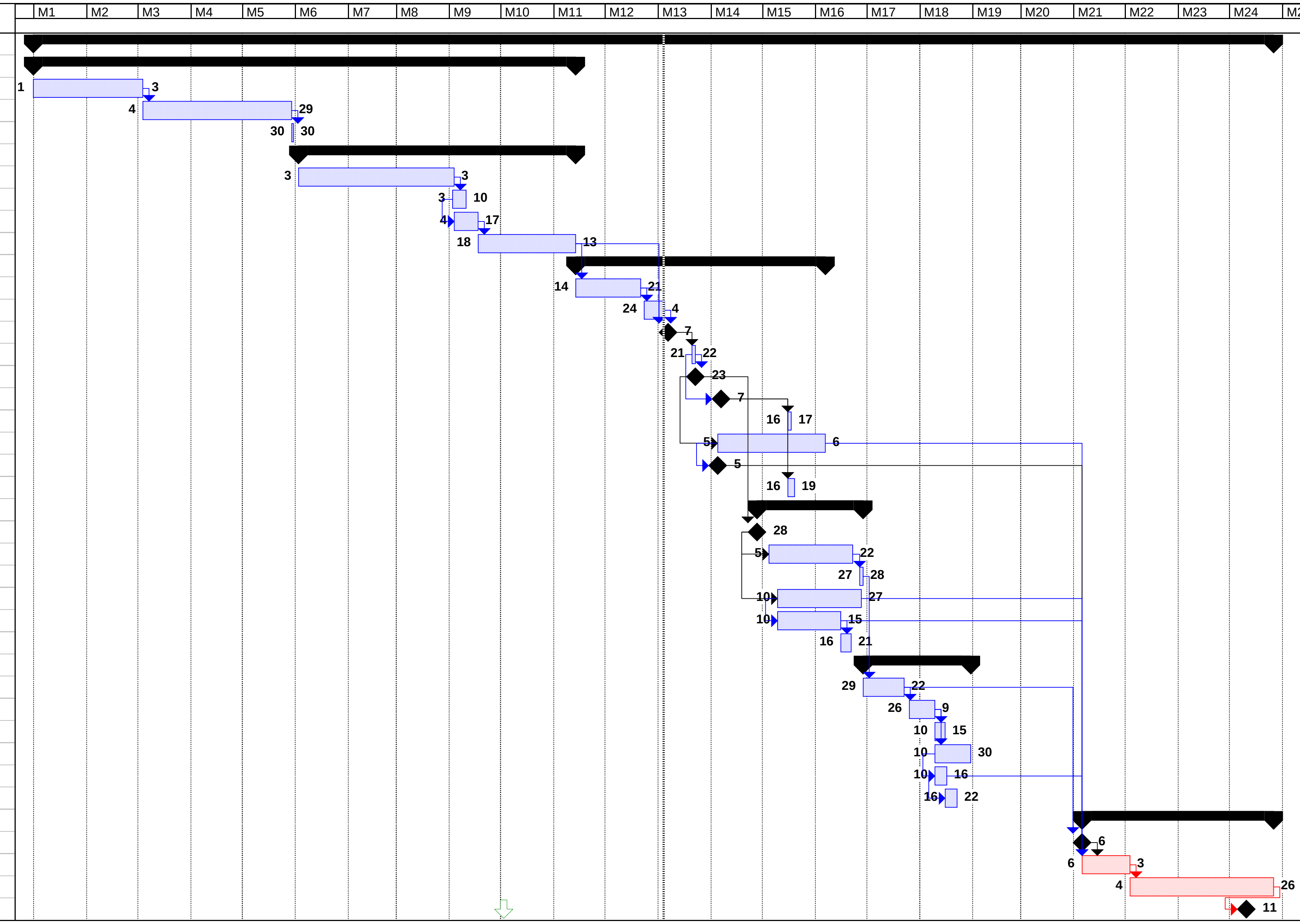
____
(Health Physicist Signature)

____________________ ______________________
(Date) (Time)

APPENDIX D FIGURE 3-1

REMEDIAL ACTION SCHEDULE
LI TUNGSTEN SUPERFUND SITE
GLEN COVE, NEW YORK

ID	Task Name	Duration	Month
1	**LI TUNGSTEN SUPERFUND SITE**	**506 days**	**1**
2	**REMEDIAL ACTION SUBMITTALS**	**220 days**	
3	Preparation of Revised RA Work Plan	45 days	
4	USEPA Review of Revised RAWP	60 days	
5	USEPA Approval of RA Work Plans	1 day	
6	**Disposal Site Research and Definitization**	**114 days**	
7	Site Mobilization	64 days	
8	Clearing / Grubbing	6 days	
9	Site wide MAC and WAC Sampling and Surveying	10 days	
10	Waste Material Acceptance - Rad and Metals	40 days	
11	**REMEDIAL ACTION - Parcel B&C Rad and Parcel B Metals**	**102 days**	**11**
12	Site Mobilization and Setup	27 days	
13	Clearing / Grubbing	10 days	
14	Excavation of Radiological Contaminated Soil and stockpile in Dickson	10 days	
15	Decontamination and Release of Equipment	2 days	
16	Excavation of Metals Contaminated Soil Parcel B (11,679 CY)	25 days	
17	Transport of Metals Contaminated Soil Parcel B direct Loads in Excavations (15,182 TON)	27 days	
18	Decontamination and Release of Equipment	2 days	
19	Final Status Survey - Radiological for Parcel B	45 days	
20	SW846 (Final Status Survey) - Metals for Parcel B	30 days	
21	Site Restoration - Parcel B	4 days	
22	**REMEDIAL ACTION - Parcel C Metals**	**42 days**	**15**
23	Excavation of Metals Contaminated Soil Parcel C (13,886 CY)	31 days	
24	Transport of Metals Contaminated Soil Parcel C direct Loads in Excavations (18,050 TON)	35 days	
25	Decontamination and Release of Equipment	2 days	
26	Final Status Survey - Radiological for Parcel C	33 days	
27	SW846 (Final Status Survey) - Metals for Parcel C	27 days	
28	Site Restoration - Parcel C	4 days	
29	**REMEDIAL ACTION - T&D Rad Soils in Dickson and Dickson Decon/Release**	**43 days**	**16**
30	Transportation of Rad Contaminated Soil from Dickson Warehouse (7500 TON)	18 days	
31	Decontamination of Dickson Warehouse	10 days	
32	Decontamination and Release of Equipment	4 days	
33	Closure Survey of Dickson Warehouse	15 days	
34	Final Status Survey of RMA's	5 days	
35	Demobilization	5 days	
36	**POST REMEDIAL ACTION ACTIVITIES**	**80 days**	**20**
37	Final Inspection	0 days	
38	Draft Post Remedial Action Report Development and Submittal	20 days	
39	EPA review of Final Submittals	60 days	
40	Address EPA Comments and submit Final PRAR	12 days	



NOTE: Month "M1" Chronologically Corresponds with August 1, 2005.

Project: proj_sched1
Date: Fri 8/4/06

Task		Progress		Summary		Rolled Up Critical Task		Rolled Up Progress		External Tasks	
Critical Task		Milestone		Rolled Up Task		Rolled Up Milestone		Split		Project Summary	

Group By Summary

Deadline